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SCREENING OF WILD RELATIVES FOR RESISTANCE BREEDING IN OKRA

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ABSTRACT

Okra or bhendi is the only commercial vegetable crop of the Malvaceae family. India stands first in area and production of okra in the world. At the same time, the crop is also affected by various pest and diseases. None of the varieties released are persistence in resistance. Hence new breeding lines and breeding tools are introduced to curtail the uncertainty in this tetraploid allogamous crop. During 2014-15, a preliminary study with four wild genotypes and Arka Anamika (control) were selected from the *in-vivo* germplasm maintained at the Department of Horticulture, AC&RI, Madurai, Tamil Nadu, India. The genotypes were evaluated for various morphological, reproductive and YVMV scaling and comprehensive results were obtained. There were significant differences for the characters accessed. The wild genotypes were entirely different from the cultivated type for the characters viz., number of branches per plant, days to flowering, pod length, pod girth, pod weight, total crop duration, stem pigmentation and YVMV resistance. All the four wild genotypes were immune to YVMV. Based on the present investigation, all the four genotypes can be successfully deployed as clones for okra grafting programme.

KEYWORDS: Okra, Root Stocks, Cuttings, YVMV

INTRODUCTION

Okra or bhendi or Ladies finger (*Abelmoschus esculentus* L.) belongs to the family Malvaceae. Okra is an important tropical and subtropical vegetable crop of many regions of the world. It is widely cultivated in India, Nigeria, Sudan, Pakistan, Ghana, Egypt, Benin, Saudi Arabia, Mexico and Cameroon (Anon, 2011). It is good source of vitamin A, folic acid, carbohydrates, phosphorus, magnesium and potassium (IBPGR, 1990). Among the different countries, India ranks first in both area and production followed by Nigeria. Higher productivity was reported from Egypt (12.5 tons/ha) followed by Saudi Arabia (13.3 tons/ha). In India, okra is almost grown in all the states, in an area of 5.30lakh hectare and the total production was 62.88lakh MT. Andhra Pradesh is the leading okra producing state which has production of around 1184.2 thousand tons followed by West Bengal (862.1 thousand tons) and Tamil Nadu ranks in 14th in production (Anon, 2012). In Tamil Nadu, okra is grown in an area of 346 ha with annual production of 5183MT averaging 15t per hectare (Bathla, 2013).

ToMV resistance level of scion is recommended to be the same as that of rootstock (Yamakawa, 1982). Oda (1999) reported that, *S. aethiopicum* is used as a rootstock for control of soilborne diseases like Verticillium wilt in

commercial grafted eggplant production. In okra, yield losses caused by Yellow Vein Mosaic Virus vary from 25 to 100% depending upon the stage at which the plant is infected and its neither sap nor seed but vector transmitted disease (Verma and Yogesh, 2013). Host genetic resistance to viruses is one of the most practical, economical and environment-friendly strategies for reducing yield loss in okra. The transfer of resistance from wild relatives has been hampered by sterility problems and it is difficult to produce subsequent generations or even carry out backcrosses (Sanwal, 2014).

To develop successful grafts in this amphidiploid allogamous direct seeded crop, root stocks are to be screened and standardized. With this broad objective, a preliminary study was conducted to select wild relatives suitable for hybridization and grafting in okra.

MATERIALS AND METHODS

With this broad back ground of okra, the *in-vivo* germplasm maintained at the Department of Horticulture, AC&RI, Madurai, satellite campus of Tamil Nadu Agricultural University were investigated from 2004. During 2011, four wild genotypes *viz.,* EC755655, EC75565, EC755658 obtained from AVRDC, Taiwan were identified for their YVMV immunity under natural conditions in various seasons and Arka Anamika (National check) were utilized for this investigation. The study was initiated at the campus Orchard in Randamoized Block Design with five replications. Ten plants were subjected for each observations *viz*, plant height, days to first flowering, number of branches per plant, inter nodal length, days to first flowering, pod length, pod girth, pod weight, yield per plant, crop duration and YVMV incidence were recorded during 2014 to 2015. Based on the YVMV disease ratings scale (Ali *et al.* 2005), the genotypes were characterized as immune or resistant or tolerance. The statistical parameters like mean, standard error and coefficient of variation were calculated as per the standard methods of analysis (Panse and Sukhatme, 1985) using AGRES software for analysis.

RESULTS AND DISCUSSIONS

The results of the present investigation are briefly presented and discussed. The height of the plant varied significantly within the genotypes (Table 1). Taller plants were observed in the genotype EC755656 (125.32cm) and significantly different from other genotypes. Similar findings by Reddy *et al*. (2013) reported a range of 78.85 to 99.51 cm for plant height among the parents and 77.7 to 104.54 cm among hybrids. Dwarf plants were recorded in EC755657 (68.95cm). Two genotypes exceeded the grand mean of 88.80cm.

The number of branches per plant (Table 1) ranged between 7.54 in EC755655 and 2.35 branches in Arka Anamika (control). Profuse branching was observed in EC755656 and was significantly different from other genotypes. Four genotypes exceeded the grand mean of 5.94 branches. Pradeep and Singh (2012) found that, number of branches per plant in okra ranged from 2.33 to 5.66 and 3.33 to 6.33 in parents and hybrids respectively.

The internodal length (Table 1) was higher in the genotype EC755656 (8.45 cm) and least in EC755655 (5.42cm). The genotype EC755656 was significantly different from other genotypes. Three genotypes exceeded the grand mean on 7.20cm. Aneesha (2010) recorded that, internodal length ranged from 3.2 to 4.7 cm for internodal length was observed for okra genotypes. But in the current study, the internodal length varied much and it may be due to multiple branching habit exhibited by the wild genotypes.

Table 1: Morphological Traits of Okra Genotypes

Treatments	Plant Height (Cm)	Branches Per Plant	Inter Nodal Length (Cm)
EC755655	78.54^{c}	**7.54^{a*}**	5.42^{e}
EC755656	**125.32^{a*}**	6.28^{d}	**8.45^{a*}**
EC755657	68.95^{e}	6.94^{b}	7.88^{c}
EC755658	75.36^{d}	6.58^{c}	6.25^{d}
Arka Anamika (Control)	95.85^{b}	2.35^{e}	7.99^{b}
Mean	**88.80**	**5.94**	**7.20**
SEd	0.45	0. 04	0.02
CD(0.05)	0.96	0.09	0.05

There was wide variation observed for days to first flowering (Table 2) in the current investigation. The variety Arka Anamika exhibited much earlier flowering (30.55 days) and delayed flowering were observed in almost all the wild genotypes. All the four wild types exceeded the grand mean of 86.11 days. Kumar *et al*. (2011) reported that number of days to first flowering among the parents as 32.15 and among the F_1 hybrids as 39.51 days. On contrary, the days to first flowering varied from 30.55 days to 105.55 days. To exploit the traits of the wild genotypes, flower synchronization is necessary. But the flowering in the wild genotypes commence after the cropping season of the cultivated varieties. Hence, alternate propagation methods are necessary to produce early flowering and inturn viable hybrids.

Table 2: Reproductive Traits of Okra Genotypes

Treatments	Days to First Flowering (Days)	Pod Length (Cm)	Pod Girth (Cm)	Pod Weight (G)	Yield per Plant (G/Plant)	Crop Duration (Days)
EC755655	105.55^{e}	7.85^{b}	**9.14^{a*}**	4.88^{d}	174.80^{e}	290.65^{d}
EC755656	101.23^{d}	6.94^{d}	7.12^{d}	5.13^{c}	184.54^{c}	320.55^{b}
EC755657	94.67^{b}	7.14^{c}	8.35^{b}	5.96^{b}	189.35^{b}	326.53*^{a}
EC755658	98.56^{c}	6.24^{e}	7.62^{c}	6.01^{b}	179.24^{d}	310.22^{c}
Arka Anamika (control)	**30.55^{a*}**	**13.56^{a*}**	7.15^{d}	**14.57^{a*}**	**243.17^{a*}**	110.35^{e}
Mean	**86.11**	**8.35**	**7.88**	**7.31**	**194.22**	**271.66**
SEd	0.41	0.05	0.014	0.07	1.03	2.05
CD(0.05)	0.92	0.10	0.030	0.14	2.17	4.15

The length of the pod (Table 2) varied significantly from 6.24 in EC755658 to 13.56 cm in Arka Anamika. Only one genotype exceeded the grand mean of 8.35cm. It was observed that the wild genotypes are shorter in length as compared to the control. **Ramya and SenthilKumar (2010)** reported in okra that the highest fruit length was 18.23 cm for Punjab Padmini and 18.78 cm for the hybrid Pusa A 4 x Punjab Padmini. Regarding the girth of the pod, significant differences were observed between the genotypes under study. Broader pods were observed in EC755655 (9.14cm) and it was significantly differed from other genotypes. The genotype Arak Anamika (7.15cm) was on par with genotype EC755656 (7.12cm). In the wild genotypes fruits are almost oblong as compared to the cultivated control. The individual pod weight of the wild genotypes was much lower as compared to the cultivated variety. The pod weight ranged from 4.88g (EC755655) to 14.57g (control).

Significant differences for yield per plant (Table 2) were observed among the genotypes under study. Higher yield was observed in Arka Anamika (243.17g) while lower yield in EC 755655 (174.80g). Reddy *et al*. (2013) reported that, the yield ranged from 126.06 to 185.00g among okra parents. In the present investigation, all the wild genotypes exhibited terminal bearing with long pedicle in contrast to the cultivated type where in the pod bears at each internode. Several

secondary growth were observed in the wild after cessation of reproductive phase in the main stem. The duration to complete one full life cycle of the plant were observed and found that all the wild genotypes were above the grand mean of 271.66 days. It's also noted that, these genotypes survive even under non-cropping season, which can be key note for the breeders to produce varieties for offseason okra production.

The stem colour varied between the genotypes under study (Table 3). All the wild genotypes exhibited red tinge on the dorsal side of the stem while fully green in the cultivated type. The YVMV scaling test was performed for all the genotypes under study under natural infestation for a period of four years. It was observed that, none of the wild genotypes were infected by YVMV and rated as immune. On the other hand, the control had 36.40% incidence of YVMV and interpreted as Tolerant. Similar findings were reported by **Vinod *et al*. (2000).**

Table 3: Stem Colour and YVMV Scaling of Okra Genotypes

Genotypes	Stem Colour	YVMV Scaling
EC755655	Red on dorsal side	Immune (0.00%)
EC755656	Red on dorsal side	Immune (0.00%)
EC755657	Red on dorsal side	Immune (0.00%)
EC755658	Red on dorsal side	Immune (0.00%)
Arka Anamika (control)	Full Green	Tolerant (36.40%)

CONCLUSIONS

From the present investigation, all the four wild genotypes viz., EC755655, EC755656, EC7556557 and EC755658 were found to be immune to YVMV under natural conditions. Hence, these genotypes can be successfully deployed to for resistance breeding through hybridization programme due to its acclimatization for a period of five years of introduction. The presence of multiple shoot formation in wild genotypes indicates the possibility of propagation through cuttings and parents can be maintained as clone. With high branching ability and long duration, the genotypes may successfully be deployed as rootstocks in okra grafting programme in the near future.

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